Venture Capital Availability and Labor Market Performance around the World

By Horst Feldmann

Abstract. This paper studies the effects of venture capital on the performance of the labor market. Using data from a much larger sample of countries than previous papers, it finds more readily available venture capital to favorably affect both the unemployment and the employment rate. The magnitude of the estimated effects is substantial. We control for both endogeneity of venture capital availability and most major determinants of labor market performance. The results are robust to variations in specification.

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1. Introduction

From the early 1990s to the late 2000s, venture capital activity has varied considerably, both through time and across countries. After a slow start in the early 1990s, the second half of that decade was marked by an unprecedented boom in venture capital fundraising. After the bursting of the dot-com bubble in 2000, this boom was followed by several years of muted activity. Then there was a revival in the years 2005 to 2007, which ended when the recent global financial crisis hit.

As is well known, the United States has the largest venture capital industry (Gompers and Lerner 2001). What is less well known is that venture capital is also an important source of funding for young high-potential companies in many other countries. Examples include established industrial countries such as Australia, Finland, Ireland, the Netherlands and the United Kingdom, newly industrialized countries such as Hong Kong, Israel, Singapore and South Korea, emerging markets such as China and India as well as some developing countries such as Chile and Malaysia (Aylward 1999, Jeng and Wells 2000, Bottazzi and Da Rin 2002).

So far, only few studies have analyzed the labor market effects of venture capital. This paper is the first to use a large sample of countries – in fact, no fewer than 78. By contrast, most previous papers use data from a single country, with a few using data from only 20 countries. Furthermore, our paper is the first to cover not just the boom and bust around the turn of the century but also the revival of venture capital fundraising during 2005-07.

Our paper is also one of the first to focus on the macroeconomic side. By contrast, most previous studies use firm-level data. Such studies focus on the employment effects in venture-funded firms. They are unable to measure if venture capital benefits the labor market as a whole.

Our paper also innovates because it uses an indicator of access to venture capital that has been used in one previous study only (Feldmann 2010). It is based on surveys among senior business executives and, as explained below, can help to shed new light on the effects of venture capital. Our paper goes beyond the Feldmann (2010) study not only because it uses a much larger sample of countries and data from more recent years. Additionally, in contrast to that study, the estimates for our venture capital variable presented here are fully robust to endogeneity.

The following section briefly discusses the transmission channels through which venture capital is likely to affect labor market performance. Section 3 summarizes the results from previous empirical studies. Section 4 describes our measure of venture capital availability. Section 5 explains our control variables. Section 6 describes our dependent variables, sample and estimation method. Section 7 presents and discusses the regression results. Section 8 concludes.

2. Possible transmission channels

Venture capital is likely to affect labor market performance through several channels. For example, improved availability of venture capital lessens firms' financial constraints, enabling them to create new jobs. Usually, financial constraints are especially critical for young, new technology-based firms (Carpenter and Petersen 2002, Colombo and Grilli 2007). These are exactly the firms that venture capitalists target. In many countries, young firms and other small and medium-sized enterprises (SMEs) are also the firms that create most of the new jobs (OECD 2009). Thus by lessening financial constraints, venture capitalists also lessen an important constraint for the creation of jobs.

Firms' improvement in their financial situation often goes beyond the funds provided by venture capitalists, due to improved access to two other sources of funding. First, venture backing improves access to bank loans. For example, using data on 10,578 US companies over 1980 to 2000, Hellmann et al. (2008) find that having had a prior relationship with a company in the venture capital market increased a bank's likelihood of subsequently granting a loan to that company, and that the relevant companies benefited from this relationship not only through more readily available loans but also through more favorable loan pricing. Second, venture backing improves access to the stock market. For example, using a sample of 350 American biotechnology firms financed by venture capital between 1978 and 1992, Lerner (1994) finds that venture capitalists were proficient at taking these companies public when equity valuations were high. Similarly, comparing 320 venture-backed IPOs with a matched control sample of 320 non-venture-backed IPOs in the US from 1983 to 1987, Megginson and Weiss (1991) find that the presence of venture capitalists served to lower the total costs of going public and to maximize the net proceeds. Using data on 136 venture-backed and 136 non-venture-backed IPOs in the United States for 1976 to 1988, Jain and Kini (1995) find that the former exhibited relatively superior post-issue operating performance compared to the latter. Taken together, these four studies suggest that the venture capital industry acts as a catalyst for financial resources, enabling venture-backed firms to expand well beyond what that industry would be able to

fund on its own accord. As these firms are able to grow substantially using bank loans and the stock market as additional sources of funding, they are able to also substantially increase their staff, which in turn is likely to raise aggregate employment levels and reduce the unemployment rate in the economy.

The support venture capitalists provide goes well beyond providing finance (e.g., Lerner 1995, Kaplan and Strömberg 2003, 2004). Additionally, they closely monitor the evolution of the firms they fund, provide their management with advice and help them hire the right experts, for example in marketing. Furthermore, they provide the firms with a network of contacts with potential suppliers, customers and "infrastructure providers" such as accounting and law firms. The reputation of being venture-backed helps firms to hire top experts and obtain new contracts. Also, venture capitalists step in and take control when times get difficult, removing the entrepreneur from his post as CEO, if necessary. All of this non-financial support helps venture-backed firms establish themselves in the market place and grow. As they increase their workforce, aggregate labor market performance improves.

Venture capital is also likely to improve labor market performance because it helps to stimulate and commercialize innovation. For example, using data on 20 US manufacturing industries for the period 1965 to 1992, Kortum and Lerner (2000) find that increases in venture capital activity in an industry are associated with significantly higher patenting rates. They estimate that venture capital may have accounted for 8% of industrial innovations during 1983-1992. Using a large database that comprises virtually all firms registered in the German trade register and applying matching procedures to compare venture-funded firms with non-venture-funded matched firms, Engel and Keilbach (2007) find that the former have higher numbers of patent applications. They also find that these are obtained before the venture capital investment and thus conclude that venture capitalists choose firms with proven innovation output. Similarly, using data on the US manufacturing industry for 1968 to 2001, Hirukawa and Ueda (2011) find that higher innovation is often positively and significantly related to future venture capital investment. Using data on 149 Silicon Valley high-tech start-ups from the period 1994 to 1997, Hellmann and Puri (2000) find that innovator firms were more likely to obtain venture capital than imitator firms. According to their results, venture capital was also associated with a significant reduction in the time to bring a product to market, especially for innovators. Higher rates of innovation and better commercialization of innovation are likely to improve labor market performance not only because the development and production of innovative goods create jobs but

also because innovations improve the international competitiveness of innovative firms and thus of the economy as a whole.

Venture capital is likely to have positive employment effects not only in venture-funded firms but in other firms as well. First, consider the innovation channel. Other firms can benefit from innovations by venture-backed firms in various ways – for example, by producing goods that are complementary to the innovative goods; by providing services or intermediate products that venture-backed firms need in order to produce and sell their innovative goods; or by applying new production processes invented by venture-backed firms, thereby possibly improving their international competitiveness. Thus non-venture backed firms somehow involved in the innovation process are likely to prosper and take on new staff, magnifying the aggregate employment effect in the economy.

The finance channel, too, is likely to trigger employment effects that go beyond venture-backed firms. This is because for potential entrepreneurs the odds of obtaining funding improve as a growing venture capital industry lessens firms' financial constraints. Thus they are more likely to start a business, even if they initially do not use venture capital (Samila and Sorenson 2011). All newly founded companies create jobs, improving labor market performance. Of course, this is also true for firms that are not, or at least initially not, funded by venture capital.

Finally, consider the "soft side" of venture capital. Venture capitalists provide venture-backed firms with a wealth of expertise on how to build a successful company as well as with various useful contacts. Often, this leads to spin-offs – i.e., to employees leaving to start their own business, taking advantage of the expertise and contacts acquired during their time at a venture-backed firm (Samila and Sorenson 2011). Because these spin-offs create jobs as well, they, too, contribute to improving labor market performance.

3. Previous empirical research

As mentioned in section 1, of the few previous papers studying the labor market effects of venture capital, most use firm-level data. They combine data on venture-backed firms with data on similar non-venture-backed firms to estimate if venture funding affects the number of jobs in the former companies. The key limitation of these papers is that they are unable to measure the effects in the wider economy. As argued in section 2, these effects may be substantial.

Almost all previous studies find venture capital to positively affect employment. Let us start with the firm-level studies. Lerner (1999) analyzes the effects of the Small Business Innovation Research program in the US – a major policy initiative to support high-tech firms in which the government effectively acted as a venture capitalist. He finds that, between 1983 and 1995, program awardees achieved substantially greater employment growth and were significantly more likely to attract private venture financing than similar firms not assisted by the program. Davila et al. (2003) use data gathered in the period 1994-2000 on 193 venture-backed start-ups and 301 non-venture-backed start-ups in the US, mostly Silicon Valley-based companies in technology industries. They find that the number of employees increased in the months prior to a venture capital funding round and accelerated in the months after the event. Bertino et al. (2011) use data from 1994 to 2003 on 538 start-ups in 11 Italian high-tech manufacturing and services sectors. 58 of these start-ups were backed by venture capital. According to Bertino et al.'s (2011) estimates, venture capital investments had a large impact on employment growth, in most cases immediately after the first round of venture capital finance. In their study of German firms, Engel and Keilbach (2007) find that employment growth in venture-funded firms was roughly twice as large as in non-venture-funded matched firms. The only study unable to find positive employment effects is the one by Bottazzi and Da Rin (2002). Using data for the years 1996 to 2000 on 511 companies listed on Europe's "new" stock markets, these researchers do not find any impact of venture capital on employment growth in the period of (up to) three years after the IPO.

Two studies use regional rather than firm-level data. The first, Jenkins et al. (2008), examines change in the share of high-tech employment in US metropolitan areas between 1988 and 1998. It finds that private venture capital firms had direct effects on the share of high-tech employment, along with technology grant and loan programs, research parks and military R&D. It also finds research parks to magnify the effects of private venture capital firms. The second study, Samila and Sorenson (2011), also uses data on US metropolitan areas, in this case covering the 1993-2002 period. It finds that investing venture capital in an additional firm stimulated the entry of two to twelve establishments, i.e., more new firms than actually funded. Additionally, it finds that a doubling in the number of firms funded by venture capital resulted in a 0.22% to 1.24% expansion in the number of jobs at the regional level.

To date, there are few cross-country macro-level studies. Using data on 20 established industrial countries for the period 1986 to 1999, Belke et al. (2004, 2005, 2006) find that venture capital

investment tends to reduce unemployment and to raise employment. They also find the positive impact of venture capital investment on employment growth to be more dynamic than static in nature, hypothesizing that this may be because it takes time for venture capital investments to realize their full employment potential via feedback and trickle down effects on other firms. Feldmann's (2010) paper covers the same 20 countries but a longer period, 1982-2003. In line with Belke et al. (2004, 2005, 2006), he finds that more readily available venture capital is likely to have lowered the unemployment rate and raised the employment rate. Additionally, he finds that it is likely to have reduced the share of long-term unemployed in the total number of unemployed. According to these cross-country macro-level studies, the magnitude of the effects was substantial. For example, according to Feldmann (2010), in the US from 1982-83 to 1999-2000, the greater availability of venture capital might have caused the unemployment rate to fall by 0.9 percentage points, the employment rate to rise by 1.3 percentage points, and the long-term unemployment share to drop by 4.4 percentage points.

4. Venture capital availability variable

To measure access to venture capital, this paper uses results from the World Economic Forum's annual *Executive Opinion Survey* (EOS). The respondents were CEOs or other members of companies' senior management. In each country, on average 74 executives participated. The industry structure of the companies questioned corresponded largely to the industry structure of the relevant economy (excluding the agricultural sector). Also, care was taken to question companies of various size categories and types (e.g., private and state-owned, domestically oriented and internationally active enterprises).[1]

The typical EOS question asks participants to indicate on a numerical scale to what extent they agree or disagree with a specific statement. After the survey was conducted, country-level average scores were calculated for each question. Table 1 contains the questions on venture capital availability used in the *Executive Opinion Surveys*. As can be seen from the table, all questions are phrased in a similar way. There are some slight variations but these are only refinements in style to make the questions

[1] Over time, there have been some changes to the World Economic Forum's surveys that are of minor importance to our analysis. First, between 1989 and 1995 the surveys were conducted in collaboration with the Institute for Management Development, Lausanne, and between 1996 and 2001 in collaboration with the Center for International Development at Harvard University. Second, the average number of respondents per country fluctuated somewhat from year to year; in our sample period the minimum was 57 (1993) and the maximum 94 (2005). Third, the number of countries covered increased substantially over our sample period, from 36 in 1992 to 131 in 2007.

more precise. Thus the responses to all questions can be used simultaneously. As the World Economic Forum applied different scales over the years, we re-scaled all scores to vary from zero to one (with higher values indicating that venture capital is more readily available). There is substantial variation in our measure, ranging from a minimum of 0.12 to a maximum of 0.90, with a sample mean of 0.46 and a standard deviation of 0.16.

The EOS data on venture capital availability have several advantages, especially compared with hard data such as the ratio of venture capital financed investment to GDP (used by Belke et al. 2004, 2005, 2006). First, they are available for a much larger number of countries than hard data. Second, the EOS statements permit a better coverage of the overall process of venture capital financing, from "seed funding" to "bridge financing". By contrast, as venture capital financing is not recorded officially and is often small-scale, a substantial part of it may have gone unrecorded in the hard data. Third, whereas the measurement of venture capital financing is not harmonized internationally, the EOS statements were the same for all countries. Fourth, the respondents have good knowledge of and often practical experience with the venture capital industry of their countries of residence.

Potential drawbacks also have to be considered in connection with the use of the EOS data:

– One cause for concern is that each respondent may have used his own yardstick when answering the questions. However, in the planning, implementation and analysis of the surveys, care was taken to ensure the use of a uniform yardstick. For one, the respondents were provided with a written explanation of the answering scale.[2] Also, the answers were examined for robustness and consistency using various methods. In one of these checks, half of the answers from each country were randomly dropped from the sample. As the national EOS scores remained stable, they have obviously not been distorted by individual peculiarities in responding (e.g., Blanke et al. 2003, pp. 372-375).
– Another potential drawback is that the answers may be distorted by the economic climate prevailing at the time the survey was conducted. For example, some respondents may answer more positively in a favorable economic climate. However, the country-level average scores are unlikely to be distorted in this way for three reasons. First, as mentioned previously, the national EOS scores remained stable when the World Economic Forum's researchers randomly dropped from the sample half of the answers from each country. Second, the correlation coefficient between our 'venture capital availability' variable and the 'GDP growth rate' variable is small (-

[2] Blanke et al. (2003, p. 370) quote an example of the written explanation of the answering scale. It does not refer to a question on venture capital availability though, but to a question on the level of sophistication of financial markets.

0.05) and statistically insignificant. Third, we control for the impact of the economic climate (section 5).

– There may be further reasons why the national EOS scores may not accurately reflect cross-country differences in the availability of venture capital. For instance, respondents in a country may have a similarly biased assessment of the availability of venture capital if this topic has recently been discussed extensively and with a certain flavor in the media. Also, the questions may be interpreted differently in different countries. The authors of the *Executive Opinion Surveys* tried to avoid this problem by providing all respondents with a written explanation of the answering scale and by asking them to think in world terms rather than in national terms.[3]

Thus although we cannot be sure that the EOS data accurately reflect the availability of venture capital in each and every case, it seems likely that they come fairly close to this ideal. Also, as pointed out previously, they have several additional advantages, especially compared with hard data. For these reasons, they can help to shed useful new light on venture capital and its effects on the economy.

5. Control variables

We control for the impact of most major factors that have been found to affect labor market outcomes in large samples of countries (for definitions, sources and descriptive statistics of all variables, see Table 1). For example, we control for the impact of labor market regulation because strict regulation tends to increase unemployment and reduce employment (e.g., Nickell et al. 2005, Feldmann 2009). Furthermore, we control for the impact of income and payroll taxes, which are also likely to worsen labor market performance (e.g., Prescott 2004).

We use two control variables to ensure that our 'venture capital availability' variable does not proxy for the financial system as a whole: 'private credit' and 'stock market total value traded'. Countries with more highly developed financial systems are likely to have larger and more active venture capital industries. Indeed, there is moderate correlation between 'venture capital availability', on the one

[3] It is possible that some respondents were not properly aware of venture capital availability in other countries. However, many respondents were from large and/or foreign-owned companies (see, e.g., Blanke et al. 2003, pp. 370-372) and were thus certainly able to think globally. Furthermore, as mentioned previously, the national EOS scores remained stable when the World Economic Forum's researchers randomly dropped from the sample half of the answers from each country. Both facts suggest that limited ability to think in world terms, which may have been a problem for some respondents from small companies, is unlikely to have biased the national EOS scores.

hand, and both ‘private credit’ (correlation coefficient 0.61) and ‘stock market total value traded’ (0.57) on the other.

Furthermore, we control for the impact of the real interest rate because a rise in the real interest rate tends to reduce investment and labor demand, thus lowering employment and raising unemployment (e.g., Fitoussi et al. 2000, Feldmann 2013). We also control for the impact of inflation. High inflation rates distort relative prices, hampering an efficient allocation of resources. Furthermore, as profits are mostly taxed on a nominal basis, enterprises’ real net return on investment decreases in an inflationary environment so that investment is likely to decline. Both effects may lead to lower employment and higher unemployment. Alternatively, if nominal wages are downward rigid, inflation may, upon the occurrence of shocks, facilitate the adjustment of real wages, improving labor market performance. Indeed, there is evidence for a permanent trade-off between inflation and unemployment at modest inflation rates in the United States (Akerlof et al. 1996, 2000, Groshen and Schweitzer 1999) and other industrial countries (Wyplosz 2001).

We additionally control for the impact of trade openness. On the one hand, more openness to trade may lead to a more efficient international allocation of labor, increasing employment and lowering unemployment (Grossman and Rossi-Hansberg 2008, Felbermayr et al. 2011). On the other hand, there is evidence that it has adversely affected low-skilled workers in industrial countries (OECD 2007).

Because labor market performance is usually strongly affected by economic growth, we include the ‘GDP growth rate’ variable throughout. We also use a dummy variable for wars because they may severely disrupt the labor market. For two reasons, we also include the ‘GDP per capita’ variable. First, to account for the effects of the large cross-country differences in the level of economic development. Second, as richer countries usually have more highly developed venture capital industries, it is important to ensure that our ‘venture capital availability’ variable does not proxy for the level of economic development. Indeed, there is substantial correlation between our variable of interest and ‘GDP per capita’ (correlation coefficient 0.70).

In two robustness checks, we additionally use two alternative indicators of financial system regulation. The main reason to do so is to ensure that our ‘venture capital availability’ variable does not proxy (inversely) for the impact of this type of regulation because countries with stricter regulation of their financial systems are likely to have smaller and less active venture capital

industries. Indeed, 'venture capital availability' is moderately correlated with both 'credit market regulation' (correlation coefficient -0.49) and 'financial sector regulation' (-0.43). The second reason to control for financial system regulation is that some theoretical and empirical studies suggest that it can adversely affect labor market performance (e.g., Acemoglu 2001, Feldmann 2006).

In one robustness check, we additionally control for the impact of product market regulation. Theoretical studies argue that anticompetitive product market regulations (e.g., entry restrictions, price controls) will generally reduce equilibrium output and thus labor demand and employment, increasing unemployment (e.g., Blanchard and Giavazzi 2003; Pissarides 2003). Indeed, several empirical studies find evidence for such adverse labor market effects (e.g., Bassanini and Duval 2006, Feldmann 2012).

In another robustness check, we additionally control for the impact of legal restrictions on both international trade and international capital movements. Fewer restrictions of international trade can have the same opposing effects as trade openness.[4] On the one hand, they may increase the efficiency of cross-country labor allocation, raising employment and reducing unemployment. On the other hand, they may trigger job losses due to increased import competition. Fewer restrictions of cross-border financial transactions are likely to improve the efficient allocation of resources and attract FDI inflows, raising employment and reducing unemployment. However, they may also lead to erratic capital movements such as speculative in- and outflows or sudden stops, adversely affecting labor market performance.

In our final two robustness checks, we examine the impact of terms of trade shocks and systemic banking crises, respectively. An adverse terms of trade shock could worsen labor market performance because a rise in relative import prices could increase wage pressure. As the recent global financial crisis illustrated, systemic banking crises can substantially worsen labor market performance.

The variables exclusively used in some robustness checks are not included in the baseline specifications either because doing so would markedly reduce the number of countries and observations or because they are not normally considered in cross-country regressions of labor market performance.

[4] Although 'openness' and 'regulation of international trade' are negatively correlated (-0.29), the absolute value of the correlation coefficient is low, indicating that they capture different aspects of international trade.

6. Dependent variables, sample and estimation method

To measure the effects on the labor market, we use both the unemployment and the employment rate. The unemployment rate is the most important and best-known labor market measure. However, for three reasons it may be insufficient to measure labor market slack. First, in some, particularly industrial countries, governments try to hide the true extent of unemployment by offering unemployed workers generous disability or early retirement benefits. Second, in many developing countries, due to very low or absent unemployment benefits a substantial number of de facto unemployed may not register or report as being unemployed, doing subsistence farming or working sporadically in the shadow economy instead. Third, in both industrial and developing countries, many people who want and are available for a job may have given up looking for one because their prospects of finding work are poor (e.g., due to insufficient or inadequate skills, long spells of non-employment or a general lack of job openings). For these reasons, we additionally use the employment rate. Both the unemployment and the employment data are based on labor force surveys and are harmonized to a large extent.

As mentioned previously, our sample consists of 78 countries (Appendix). The sample period starts in 1992 for two reasons. First, there are gaps in the EOS data for earlier years. Specifically, while the World Economic Forum did not conduct a survey in 1985 and 1988, the 1991 survey did not include a question on venture capital availability. Second, data on some control variables (such as 'stock market total value traded') are unavailable before the 1990s. In general, with respect to both countries and years the sample size is determined by data availability only.

We run two-stage least squares regressions of the following form:

Second stage:

$$Y_{i,t} = \beta_1 V_{i,t} + \beta_2 \boldsymbol{X}_{i,t} + \alpha_i + \lambda_t + \varepsilon_{i,t}$$

First stage:

$$V_{i,t} = \sum_{s=1}^{2} \beta_3 \left(V_{i,t-s} - V_{i,t-s-1}\right) + \beta_4 \boldsymbol{X}_{i,t} + \gamma_i + \kappa_t + \eta_{i,t}$$

$Y_{i,t}$ is a labor market performance variable of country i at year t, V denotes our 'venture capital availability' variable and $\boldsymbol{X}$ is a vector of our control variables. Country fixed effects in the second- and first-stage regressions are α_i and γ_i, respectively. Year fixed effects are λ_t and κ_t, respectively, while the error terms are $\varepsilon_{i,t}$ and $\eta_{i,t}$, respectively. While country fixed effects are included to control for the impact of unobserved country-specific characteristics, year effects are included to control for the impact of shocks that are common across countries.

We instrument our 'venture capital availability' variable to extract its exogenous component. The instruments are lagged differences of the instrumented variable covering the previous three years. Lagged differences of the instrumented variable have been shown to be valid instruments, provided they pass a test for over-identifying restrictions and are sufficiently strong.[5] To test for over-identifying restrictions, we use Hansen's (1982) *J* test. We also report the first-stage *F* statistic because Staiger and Stock (1997) proposed the rule of thumb that this statistic should take on a value of at least ten; otherwise the instruments are weak. According to the results from Hansen's *J* test and the first-stage *F* statistic, our instruments are both exogenous and relevant, and thus valid (Tables 2 and 3).

To check whether random effects yield similar point estimates, we perform a further robustness check using random rather than fixed country effects. Random effects estimates have the advantage of exploiting both the cross-country and the time-series variation within the sample. By contrast, fixed effects estimates only use the time-series variation. We do not use the random effects estimator in our baseline specification because only "conventional" standard errors are available for this estimator in two-stage least-squares panel data estimation. Thus, in contrast to our fixed effects regressions, the standard errors from our random effects regressions are neither robust nor adjusted for clusters at the country level.

7. Results

Tables 2 and 3 present our regression results. While Table 2 covers regressions to explain the unemployment rate, Table 3 covers regressions to explain the employment rate. In each table, column

[5] This insight comes from, inter alia, research into GMM estimation (Arellano and Bover 1995, Blundell and Bond 1998). The latter is not an option in our case because it requires the number of cross sections to be much larger than the number of time periods as otherwise the estimates can be severely biased and imprecise (Roodman 2009a, 2009b). Thus we follow Roodman's (2009b) advice to use a fixed effects estimator instead.

1 reports the results from our baseline regression while the other columns report the results from our robustness checks.

The coefficient on 'venture capital availability' is statistically significant in each of our regressions. According to our estimates, more readily available venture capital is correlated with both a lower unemployment rate and a higher employment rate. In most robustness checks, the size of the coefficient is very similar to the estimate from the respective baseline regression.

Our results suggest that, over our sample period, the effects of venture capital on labor market performance have been substantial. Specifically, a one standard deviation increase in the 'venture capital availability' variable is associated with a fall in the unemployment rate of between 1.2 and 1.8 percentage points, ceteris paribus. It is also associated with a rise in the employment rate of between 0.8 and 1.2 percentage points, ceteris paribus. These figures are based on the smallest and the largest coefficient on 'venture capital availability' from the regressions presented in Tables 2 and 3, respectively. Of course, they should be taken with a pinch of salt. Nonetheless, they exemplify that, between the early 1990s and the late 2000s, venture capital is likely to have had substantial effects on labor market performance around the world. Thus, in many countries, the fact that venture capital was much more readily available in the second half of the 1990s and, to a lesser extent, in the period 2005-07 has probably contributed to the improvement in labor market performance during these years. Equally, the precipitous fall in venture capital availability from 2000 to 2003 has probably contributed to the decline in employment and rise in unemployment over that period. Our results also suggest that countries in which venture capital was more readily available have had better labor market performance than other countries, ceteris paribus.

As argued in section 2, more readily available venture capital is likely to have improved labor market performance through several channels: by providing venture-backed firms with investments as well as with expertise and contacts of venture capitalists; by helping these firms to innovate and commercialize innovations; and by improving their access to bank loans and the stock market. Additionally, it is likely to have improved labor market performance by benefiting not just venture-backed firms but other firms as well – for example, by involving them in the broader innovation process as well as by encouraging spin-offs and other business start-ups. As mentioned in section 2, in many countries young firms and other SMEs create most of the new jobs in the economy.

Our results accord with the previous literature on the employment effect of venture capital, which, apart from one study, also finds this effect to be positive (section 3). However, our study goes beyond all of these papers by using a much larger sample of countries and by covering more recent years. It also innovates, compared with most previous papers, by measuring the employment effect not in venture-backed firms but in the wider economy; by additionally measuring the impact on the unemployment rate; by using a new indicator of venture capital availability and instrumenting for it; and by controlling for the impact of most factors that have been found to affect labor market performance in large samples of countries.

Finally, a brief comment on the results for the control variables (Tables 2 and 3). In line with the previous literature, we find a higher real interest rate to be correlated with both higher unemployment and lower employment, probably because it reduces investment and labor demand. Also in line with the previous literature, we find positive labor market effects of GDP growth. Higher GDP per capita is correlated with lower unemployment and higher employment too, suggesting that richer countries may be better able to integrate workers into the job market. A higher degree of trade openness appears to worsen labor market performance, perhaps because it increases import competition. In line with this result, we find stricter regulation of international trade to have a positive employment effect. Positive terms of trade shocks are associated with higher unemployment, perhaps because a rise in relative export prices potentially increases wage pressure. We find no, or no robust, effects of financial sector development, regulation, taxes, inflation, banking crises or wars.

8. Conclusion

Our regression results suggest that venture capital affects labor market performance not just in some established industrial countries but in many countries around the globe. They also suggest that more readily available venture capital raises employment not just in venture-backed firms but across the economy. Furthermore, they suggest that it additionally reduces the unemployment rate. The magnitude of both the employment and the unemployment effect appears to be substantial. Our results are robust to both endogeneity of venture capital availability and variations in specification.

Although the coefficient on our ‘venture capital availability’ variable is robust and although our results are consistent with most previous studies, more research is clearly warranted. In particular, the transmission channels from venture capital availability to labor market performance need to be

more closely analyzed, both theoretically and empirically. The policy implications need to be thoroughly discussed as well. For example, should the government subsidize young high-tech companies, possibly in co-operation with venture capitalists? Should it create research or business parks for such companies? Should it provide tax breaks for venture capitalists? Alternatively, rather than using targeted interventions like these, should the government confine itself to creating a business friendly environment for all companies – e.g., by reducing both business taxes and the regulatory burden to start, run and close a business? As our results suggest, the answers to these questions may have important implications for the performance of the labor market.

Appendix. List of countries

Argentina, Australia, Austria, Bangladesh, Belgium, Bolivia, Botswana, Brazil, Bulgaria, Canada, Chile, China, Colombia, Costa Rica, Croatia, Czech Republic, Denmark, Ecuador, Egypt, Estonia, Finland, France, Georgia, Germany, Greece, Hong Kong, Hungary, Iceland, India, Indonesia, Ireland, Israel, Italy, Japan, Jordan, Kenya, Latvia, Lithuania, Macedonia, Malawi, Malaysia, Mauritius, Mexico, Morocco, Namibia, Netherlands, New Zealand, Nigeria, Norway, Pakistan, Panama, Paraguay, Peru, Philippines, Poland, Portugal, Romania, Russia, Singapore, Slovakia, Slovenia, South Africa, South Korea, Spain, Sri Lanka, Sweden, Switzerland, Tanzania, Thailand, Trinidad & Tobago, Uganda, Ukraine, United Kingdom, United States, Uruguay, Venezuela, Vietnam, Zimbabwe.

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Table 1. List of variables

	Definition	Mean	Std. Dev.	Min.	Max.	Source
Credit market regulation	Chain-linked subindex 'credit market regulations' of the *Economic Freedom of the World* (EFW) index, scaled to take values between 0 (least restrictive) and 1 (most restrictive). The subindex covers the following aspects: percentage of bank deposits held in privately owned banks, percentage of foreign banks' license applications denied, foreign bank assets as a percentage of total banking sector assets, percentage of domestic credit consumed by the private sector, extent of interest rate controls, and prevalence of negative real deposit and lending rates. Because prior to 2000 the EFW index is available on a five year basis only, the author of this paper filled the gaps by linear interpolation.	0.22	0.12	0.01	0.57	Gwartney and Lawson (2009), author's calculations
Employment protection legislation	Indicator of the stringency of employment protection legislation. Regular contracts of unspecified duration after any trial period for the job. Unweighted average of measures for advance notice period and for severance payment, each of which in turn is based on averages across three lengths of service: after 9 months, after 4 years, and after 20 years. Scores ranging from 0 (least restrictive) to 1 (most restrictive).	0.35	0.16	0.00	0.75	Aleksynska and Schindler (2011), author's calculations
Employment rate	Percentage of working-age population in employment. Age group: 15 years and older. Harmonized series.	55.48	8.60	33.90	82.90	ILO (2009)
Financial sector regulation	Index of regulation of the financial sector, scaled to take values between 0 (least restrictive) and 1 (most restrictive). The index is the unweighted average of six subindices. Five of them relate to banking: interest rate controls, credit controls, competition restrictions, state ownership, and quality of banking supervision and regulation. The sixth subindex relates to securities markets, covering policies to develop domestic bond and equity markets.	0.18	0.16	0.00	0.78	Abiad et al. (2008)
GDP growth rate	Annual growth rate of real GDP; decimal fraction.	0.04	0.03	-0.13	0.18	IMF (2010), World Bank (2010)
GDP per capita	Gross domestic product per capita, in tens of thousands of constant 2005 international dollars, converted at purchasing power parity rates.	1.79	1.21	0.02	4.80	World Bank (2010)
Inflation rate	Annual change in the consumer price index; decimal fraction.	0.07	0.23	-0.14	4.32	IMF (2010), World Bank (2010)
Labor market regulation	Chain-linked subindex 'labor market regulations' of the *Economic Freedom of the World* (EFW) index, scaled to take values between 0 (least restrictive) and 1 (most restrictive). The subindex covers the areas minimum wage, hiring and firing, centralization of collective bargaining, and military conscription. Because prior to 2000 the EFW index is available on a five year basis only, the author of this paper filled the gaps by linear interpolation.	0.46	0.13	0.08	0.75	Gwartney and Lawson (2009), author's calculations

Table 1. List of variables (cont.)

	Definition	Mean	Std. Dev.	Min.	Max.	Source
Minimum wage	Statutory minimum wage as a decimal fraction of the mean wage.	0.32	0.22	0.00	0.87	Aleksynska and Schindler (2011)
Openness	Ratio of exports and imports of goods and services to GDP.	0.89	0.67	0.16	4.39	World Bank (2010)
Private credit	The value of credit by deposit money banks and other financial institutions to the private sector as a decimal fraction of GDP. Deposit money banks comprise all financial institutions (excluding the central bank) that have liabilities in the form of deposits usable in making payments. Other financial institutions comprise financial intermediaries that do not incur liabilities usable as means of payment.	0.73	0.50	0.01	2.73	Beck et al. (2012)
Product market regulation	Index of regulatory impediments to product market competition. The index is scaled to take values between 0 and 1, with higher values indicating stricter regulation. It covers the following three sectors, with each having the same weight: agriculture, electricity, and telecommunications.	0.47	0.24	0.00	1.00	Ostry et al. (2009), author's calculations
Real interest rate	The lending interest rate adjusted for inflation as measured by the GDP deflator; decimal fraction.	0.07	0.14	-0.35	2.52	World Bank (2010)
Regulation of capital account transactions	Index of government restrictions on international financial transactions. The index is scaled to take values between 0 and 1, with higher values indicating tighter restrictions. The restrictions covered include multiple exchange rates, transactions taxes and outright restrictions on inflows and/or outflows specifically regarding financial credits.	0.11	0.22	0.00	1.00	Abiad et al. (2008)
Regulation of international trade	Index of government restrictions on international trade. The index is scaled to take values between 0 and 1, with higher values indicating tighter restrictions. It is the weighted average of two subindices. The first subindex, which has a weight of two thirds, measures average tariff rates. The second subindex measures to what extent proceeds from international trade in goods and services are free from government restrictions.	0.14	0.12	0.00	0.62	Ostry et al. (2009), author's calculations
Stock market total value traded	The value of shares traded on domestic stock exchanges as a decimal fraction of GDP.	0.43	0.56	0.00	3.58	Beck et al. (2012)
Systemic banking crises	Dummy variable that takes the value 1 if, in the respective year, the country experienced a systemic banking crisis. A banking crisis is considered to be systemic if two conditions are met: first, significant signs of financial distress in the banking system (as indicated by significant bank runs, losses in the banking system, and bank liquidations); and second, significant banking policy intervention measures in response to significant losses in the banking system.	0.09	0.28	0.00	1.00	Laeven and Valencia (2008, 2010)

Table 1. List of variables (cont.)

	Definition	Mean	Std. Dev.	Min.	Max.	Source
Terms of trade shocks	The difference between actual and smoothed terms of trade index as a decimal fraction of smoothed index. Smoothed index calculated using the Hodrick-Prescott filter ($\lambda = 6.25$). The index used is the net barter terms of trade index, which is calculated as the ratio of the export unit value indices to the import unit value indices, measured relative to the base year 2000.	0.00	0.04	-0.24	0.29	World Bank (2010), author's calculations
Top marginal income & payroll tax rate	Subindex 'top marginal tax rate' of the *Economic Freedom of the World* (EFW) index. It is scaled to take values between 0 and 1, with higher values indicating higher marginal income and payroll tax rates and lower income thresholds at which the top marginal income tax rates apply. Because prior to 2000 the EFW index is available on a five year basis only, the author of this paper filled the gaps by linear interpolation.	0.46	0.23	0.00	0.95	Gwartney and Lawson (2009), author's calculations
Unemployment benefits replacement rate	Gross unemployment benefits as a decimal fraction of previous gross wage earnings; average for the first two years of unemployment.	0.19	0.17	0.00	0.65	Aleksynska and Schindler (2011)
Unemployment rate	Unemployed as a percentage of the labor force. Labor force survey data.	8.08	4.86	0.90	36.00	European Commission (2009), ILO (2009), IMF (2010), OECD (2010)

Table 1. List of variables (cont.)

	Definition	Mean	Std. Dev.	Min.	Max.	Source
Venture capital availability	Country-level average scores of survey responses from the World Economic Forum's annual *Executive Opinion Survey* (EOS). The scores are scaled to take values between 0 and 1, with higher values indicating that venture capital is more readily available. In each country, on average 74 senior business executives were surveyed. The survey statements are as follows: 'Venture capital is not readily available for business development (= 0), or is readily available for business development (= 100)' (EOS 1992); 'Venture capital is not readily available for business development (= 0), or is readily available for business development (= 10)' (EOS 1993, 1994 & 1995); 'Venture capital is readily available for business development (1 = strongly disagree; 6 = strongly agree)' (EOS 1996); 'Venture capital is readily available for new business development (1 = strongly disagree; 7 = strongly agree)' (EOS 1997 & 1999); 'Venture capital is readily available for new business and development (1 = strongly disagree; 7 = strongly agree)' (EOS 1998); 'Entrepreneurs with innovative but risky projects can generally find venture capital (1 = strongly disagree; 7 = strongly agree)' (EOS 2000); 'Entrepreneurs with innovative but risky projects can generally find venture capital in your country (1 = not true, 7 = true)' (EOS 2001, 2002, 2003, 2004, 2005, 2006 & 2007).	0.46	0.16	0.12	0.90	World Economic Forum (1996, 1997, 1998, 1999, 2000, 2002, 2003, 2004a, 2004b, 2005, 2006, 2007), World Economic Forum and Institute for Management Development (1992, 1993, 1994, 1995)
War	Dummy variable that takes the value 1 if, in the respective year, there was a war on the country's territory. The variable takes both wars between two or more states and internal wars (with or without intervention from other states) into account.	0.03	0.17	0.00	1.00	Centre for the Study of Civil Wars (2009)

Table 2. Regressions to explain the unemployment rate[a)]

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Baseline specification	Random effects substituted for fixed effects[b)]	Alternative labor market regulation indicators	Credit market regulation added	Financial sector regulation and product market regulation added	Regulation of international trade and regulation of capital account transactions added	Terms of trade shocks added	Systemic banking crises added
Venture capital availability	-8.22** (3.55)	-7.53** (3.25)	-9.55** (3.76)	-8.15** (3.51)	-10.95** (4.34)	-10.81*** (3.87)	-9.53*** (3.60)	-7.80** (3.52)
Private credit	-0.12 (0.96)	-0.35 (0.44)	-1.59** (0.81)	-0.09 (0.94)	-0.44 (0.75)	-0.52 (0.71)	0.26 (0.86)	-0.31 (1.08)
Stock market total value traded	0.34 (0.39)	0.30 (0.28)	-0.02 (0.44)	0.37 (0.39)	-0.06 (0.66)	-0.11 (0.61)	0.34 (0.39)	0.33 (0.39)
Labor market regulation	-0.68 (1.82)	-0.28 (1.15)		-0.32 (1.81)	1.36 (2.52)	2.80 (2.13)	0.12 (1.67)	-0.56 (1.82)
Top marginal income & payroll tax rate	1.10 (1.74)	1.77* (0.92)	0.41 (2.04)	1.31 (1.71)	1.67 (2.12)	0.79 (2.07)	0.13 (2.16)	1.08 (1.73)
Real interest rate	4.95* (2.85)	2.36* (1.35)	4.69 (3.09)	5.23* (2.90)	3.82 (2.92)	5.45* (3.14)	4.28 (3.27)	4.60 (2.98)
Inflation rate	-0.02 (2.09)	-1.96* (1.10)	-0.85 (2.53)	0.76 (2.02)	1.57 (2.16)	1.76 (2.46)	-2.11 (2.13)	-0.51 (2.39)
Openness	2.67*** (1.00)	2.15*** (0.64)	1.99** (0.97)	2.71*** (1.04)	-1.23 (2.30)	2.14* (1.24)	3.28*** (0.85)	2.59*** (0.99)
GDP growth rate	-10.37*** (3.72)	-12.25*** (2.91)	-10.86*** (3.69)	-10.19*** (3.75)	-6.50* (3.65)	-6.33* (3.26)	-12.69*** (3.83)	-9.68*** (3.39)
GDP per capita	-4.89*** (1.32)	-3.36*** (0.63)	-3.77*** (1.35)	-4.98*** (1.32)	-6.59*** (1.58)	-6.08*** (1.41)	-4.29*** (1.33)	-4.90*** (1.30)
War	-0.14 (0.73)	-0.08 (0.54)	0.16 (0.62)	-0.10 (0.71)	-0.75 (1.16)	-0.50 (1.25)	-0.75 (0.54)	-0.08 (0.67)
Minimum wage			-2.71** (1.36)					
Unemployment benefits replacement rate			-0.73 (2.35)					
Employment protection legislation			0.13 (3.10)					
Credit market regulation				-2.93 (3.58)				
Financial sector regulation					0.01 (2.82)			
Product market regulation					-1.15 (2.37)			
Regulation of international trade						-4.49 (5.25)		
Regulation of capital account transactions						-1.91 (1.22)		

Table 2. Regressions to explain the unemployment rate[a)] (cont.)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Baseline specification	Random effects substituted for fixed effects[b)]	Alternative labor market regulation indicators	Credit market regulation added	Financial sector regulation and product market regulation added	Regulation of international trade and regulation of capital account transactions added	Terms of trade shocks added	Systemic banking crises added
Terms of trade shocks							4.34** (1.87)	
Systemic banking crises								0.45 (0.47)
Number of observations	575	580	507	575	414	446	497	575
Number of countries	66	71	55	66	51	55	53	66
F statistic	8.61***		12.16***	10.88***	33.47***	7.74***	8.84***	8.99***
Standard error of regression	1.47		1.44	1.47	1.49	1.46	1.43	1.47
Hansen *J* statistic (*p* value)	0.20		0.57	0.15	0.17	0.17	0.23	0.27
First-stage *F* statistic	14.10***		13.82***	13.89***	11.76***	14.97***	12.74***	17.34***

[a)]Two-stage least squares regressions with country-specific fixed effects, except for regression 2, which uses generalized two-stage least squares with country-specific random effects. 'Venture capital availability' is instrumented; the excluded instruments are lagged differences of this variable covering the previous three years. Annual data for 1992 to 2007. All regressions also contain year dummies. Standard errors are reported in parentheses. Except for regression 2, they are robust and adjusted for clusters at the country level. ***(**/*) denotes statistically significant at the 1%(5%/10%) level.

[b)]The χ^2 statistic from the Hausman test is 2.14. The *p* value from the Sargan statistic is 0.47. The Wald χ^2 statistic is 225.10***. The Wald χ^2 statistic from the first-stage regression is 284.32***.

Table 3. Regressions to explain the employment rate[a)]

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Baseline specification	Random effects substituted for fixed effects[b)]	Alternative labor market regulation indicators	Credit market regulation added	Financial sector regulation and product market regulation added	Regulation of international trade and regulation of capital account transactions added	Terms of trade shocks added	Systemic banking crises added
Venture capital availability	5.32* (3.15)	4.85* (2.74)	6.65** (3.27)	5.64* (3.18)	7.32* (3.76)	7.38** (3.64)	5.67* (3.37)	5.43* (3.25)
Private credit	1.05 (0.99)	1.14*** (0.39)	2.56*** (0.97)	1.01 (0.97)	1.05 (0.96)	1.04 (0.84)	0.70 (0.96)	0.97 (1.01)
Stock market total value traded	-0.92** (0.39)	-0.86*** (0.24)	-0.67* (0.38)	-0.95** (0.40)	-0.60 (0.52)	-0.41 (0.47)	-0.91** (0.39)	-0.93** (0.39)
Labor market regulation	1.82 (1.66)	1.64* (0.98)		1.34 (1.56)	0.97 (2.36)	-0.09 (1.72)	1.94 (1.72)	1.85 (1.67)
Top marginal income & payroll tax rate	2.05 (1.64)	1.44* (0.78)	3.06 (1.87)	1.80 (1.63)	2.06 (2.19)	2.24 (1.86)	3.10 (2.04)	2.05 (1.65)
Real interest rate	-1.79 (1.17)	-1.71*** (0.64)	-2.12* (1.11)	-1.77 (1.15)	-1.21 (0.88)	-7.97*** (1.72)	-1.54 (1.09)	-1.77 (1.18)
Inflation rate	0.32 (0.38)	0.34 (0.40)	0.35 (0.34)	0.06 (0.39)	0.06 (0.39)	-4.32*** (1.44)	0.49 (0.38)	0.30 (0.38)
Openness	-3.05*** (0.63)	-2.76*** (0.57)	-2.41*** (0.66)	-3.13*** (0.69)	-1.83 (1.94)	-2.64*** (0.67)	-3.28*** (0.55)	-3.11*** (0.63)
GDP growth rate	7.54*** (2.53)	8.08*** (2.40)	7.83*** (2.46)	7.56*** (2.59)	5.65** (2.23)	1.79 (2.24)	7.55*** (2.56)	7.97*** (2.43)
GDP per capita	3.58*** (1.26)	2.72*** (0.56)	2.99** (1.24)	3.61*** (1.27)	4.39** (1.88)	4.82*** (1.42)	3.50*** (1.32)	3.58*** (1.27)
War	-0.16 (0.32)	-0.20 (0.40)	-0.41 (0.28)	-0.21 (0.34)	-0.07 (0.56)	-0.07 (0.58)	0.04 (0.31)	-0.15 (0.33)
Minimum wage			2.00 (1.42)					
Unemployment benefits replacement rate			1.61 (1.93)					
Employment protection legislation			5.18* (2.65)					
Credit market regulation				4.39 (3.08)				
Financial sector regulation					2.63 (2.11)			
Product market regulation					-0.63 (2.10)			
Regulation of international trade						6.69** (3.39)		
Regulation of capital account transactions						1.50* (0.91)		

Table 3. Regressions to explain the employment rate[a)] (cont.)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Baseline specification	Random effects substituted for fixed effects[b)]	Alternative labor market regulation indicators	Credit market regulation added	Financial sector regulation and product market regulation added	Regulation of international trade and regulation of capital account transactions added	Terms of trade shocks added	Systemic banking crises added
Terms of trade shocks							0.17 (1.28)	
Systemic banking crises								0.19 (0.35)
Number of observations	629	632	544	629	442	470	550	629
Number of countries	75	78	59	75	55	58	62	75
F statistic	7.47***		9.67***	9.70***	7.11***	10.95***	5.52***	7.13***
Standard error of regression	1.27		1.21	1.26	1.24	1.16	1.27	1.27
Hansen *J* statistic (*p* value)	0.29		0.59	0.21	0.18	0.37	0.12	0.23
First-stage *F* statistic	13.49***		15.37***	13.44***	13.84***	19.72***	13.02***	13.66***

[a)]Two-stage least squares regressions with country-specific fixed effects, except for regression 2, which uses generalized two-stage least squares with country-specific random effects. 'Venture capital availability' is instrumented; the excluded instruments are lagged differences of this variable covering the previous three years. Annual data for 1992 to 2007. All regressions also contain year dummies. Standard errors are reported in parentheses. Except for regression 2, they are robust and adjusted for clusters at the country level. ***(**/*) denotes statistically significant at the 1%(5%/10%) level.

[b)]The χ^2 statistic from the Hausman test is 6.55. The *p* value from the Sargan statistic is 0.54. The Wald χ^2 statistic is 198.40***. The Wald χ^2 statistic from the first-stage regression is 301.35***.